



Florida Power & Light Company, 6351 S. Ocean Drive, Jensen Beach, FL 34957

November 24, 1999

L-99-254  
10 CFR § 50.73

U. S. Nuclear Regulatory Commission  
Attn: Document Control Desk  
Washington, D. C. 20555

Re: St. Lucie Unit 1  
Docket No. 50-335  
Reportable Event: 1999-006-00  
Date of Event: October 29, 1999  
Turbine/Reactor Trip Due to Ruptured  
Turbine Low Bearing Oil Trip Diaphragm

The attached Licensee Event Report 1999-006 is being submitted pursuant to the requirements of 10 CFR § 50.73 to provide notification of the subject event.

Very truly yours,

J. A. Stall  
Vice President  
St. Lucie Nuclear Plant

JAS/EJW/KWF  
Attachment

cc: Regional Administrator, USNRC, Region II  
Senior Resident Inspector, USNRC, St. Lucie Nuclear Plant

IEQA

## LICENSEE EVENT REPORT (LER)

(See reverse for required number of  
digits/characters for each block)

Estimated burden per response to comply with this mandatory information collection request: 60 hrs. Reported lessons learned are incorporated into the licensing process and fed back to industry. Forward comments regarding burden estimate to the Records Management Branch (T-6 F33), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, and to the Paperwork Reduction Project (3150-0104), Office of Management and Budget, Washington, DC 20503. If an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

FACILITY NAME (1)

St. Lucie Unit 1

DOCKET NUMBER (2)

05000335

PAGE (3)

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TITLE (4)

Turbine/Reactor Trip Due to Ruptured Turbine Low Bearing Oil Trip Diaphragm

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
10	29	1999	1999	- 006	- 00	11	24	1999	FACILITY NAME	DOCKET NUMBER
THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 1: (Check one or more) (11)										
OPERATING MODE (9)		1	20.2201(b)		20.2203(a)(2)(v)		50.73(a)(2)(i)		50.73(a)(2)(viii)	
POWER LEVEL (10)		100	20.2203(a)(1)		20.2203(a)(3)(ii)		50.73(a)(2)(ii)		50.73(a)(2)(x)	
			20.2203(a)(2)(i)		20.2203(a)(3)(iii)		50.73(a)(2)(iii)		73.71	
			20.2203(a)(2)(ii)		20.2203(a)(4)		X 50.73(a)(2)(iv)		OTHER	
			20.2203(a)(2)(iii)		50.36(c)(1)		50.73(a)(2)(v)		Specify in Abstract below or in NRC Form 366A	
			20.2203(a)(2)(iv)		50.36(c)(2)		50.73(a)(2)(vii)			

## LICENSEE CONTACT FOR THIS LER (12)

NAME

Kenneth W. Frehafer, Licensing Engineer

TELEPHONE NUMBER (Include Area Code)

(561) 467 - 7748

## COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPOX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPOX
B	TG	BLL	W120	YES	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-

## SUPPLEMENTAL REPORT EXPECTED (14)

YES (If yes, complete EXPECTED SUBMISSION DATE).	X	NO	EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
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## ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On October 29, 1999, St. Lucie Unit 1 was in Mode 1 at 100 percent reactor power. At 0105 hours the St. Lucie Unit 1 control room received annunciation of D-12 "Turbine Bearing Oil Pressure Low." Operations personnel discovered that a small amount (approximately two drops per minute) of oil was leaking from the cover of the turbine protective device trip block. The turbine/generator and reactor automatically tripped at 0129 hours. Standard post trip actions were carried out and the reactor was stabilized in Mode 3.

The cause of this event was the installation of a Westinghouse supplied defective diaphragm for the turbine low bearing oil trip protective device. The failure of this diaphragm dumped the autostop oil pressure and tripped the turbine/generator. The loss of autostop oil pressure resulted in the opening of the DEH interface valve, dumping all DEH oil pressure. The loss of DEH oil pressure resulted in the automatic trip of the reactor.

The faulty diaphragm was replaced and miscellaneous minor equipment issues were dispositioned.

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TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

**Description of the Event**

On October 29, 1999, St. Lucie Unit 1 was in Mode 1 at 100 percent reactor power. At 0105 hours the St. Lucie Unit 1 control room received annunciation of D-12 "Turbine Bearing Oil Pressure Low." Operations personnel immediately performed a visual inspection of the turbine/generator and found that all indicated bearing oil pressures were satisfactory. Further inspections discovered that a small amount (approximately 2 drops per minute) of oil was leaking from the cover of the turbine protective device trip block. While Operations personnel were discussing the actions to be taken the turbine/generator and reactor automatically tripped at 0129 hours. Standard post trip actions were carried out and the reactor was stabilized in Mode 3.

There were no problems identified with any of the safety related systems following the reactor trip and the turbine/generator trip was not caused by any safety related or primary side equipment. After the turbine trip maintenance personnel removed the cover on the turbine protective device trip block and discovered that the oil leak was from around the low bearing oil trip rod where it enters the low bearing oil trip diaphragm flange. Additional minor issues following the Unit 1 trip were identified as listed below:

1. SR09209, the 5B feedwater heater tube side relief valve, lifted,
2. The 2A and 2B main feedwater pumps both tripped upon the reset of the 15 percent feedwater bypass valves,
3. Auxiliary feedwater actuation signal (AFAS) operation abnormalities, and
4. Turbine control system oil leaks at PS-22-117 and at the 'B' intercept valve.

**Cause of the Event**

The cause for the turbine/generator automatic trip was the failure of the low bearing oil trip diaphragm [E11S:TG:BLL]. The failure of this diaphragm allowed the low bearing oil trip compression spring to reposition the low bearing oil trip rod resulting in the solenoid trip pin unseating, dumping autostop oil pressure and tripping the turbine/generator. The loss of autostop oil pressure resulted in the opening of the DEH interface valve, dumping all DEH oil pressure. The loss of DEH oil pressure resulted in the automatic trip of the reactor.

The low bearing oil trip diaphragm was found torn. Examination of the diaphragm found that it had failed partially or completely for approximately 7/8 of the circumference of the diaphragm area exposed to the autostop oil. Comparison of this diaphragm with the three diaphragms removed during SL1-16 outage found that this diaphragm is made of different material and has a different thickness than the diaphragms removed during the outage. The Westinghouse supplied diaphragm was of the wrong material. The defective diaphragm was replaced.

**Cause of Miscellaneous Equipment Issues**

1. SR09209 (5B FW Heat Exchanger Tube Side Relief Valve)

Investigation revealed that the relief valve lifted momentarily (within its design tolerance) during the higher than normal plant conditions experienced during a plant trip.



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## Cause of the Event (cont'd)

## 2. Main Feedwater Pump Trips

A minor modification was performed to the feedwater (FW) recirculation system during the 1999 fall St. Lucie Unit 1 refueling outage to prevent low flow trips of the main feedwater pumps in response to a turbine trip. Prior to the modification, the FW recirculation valves were not opening fast enough to avoid reaching the pump low flow setpoint during the transient while the main FW control valves were closing in response to the turbine trip. This modification added a turbine trip input signal from the FW bypass valve circuitry to the fail open logic of the FW recirculation control valves. The design of this circuit includes pushbutton turbine trip reset switches that allow the operator to take manual control of the bypass valves. Depressing these reset pushbuttons restores control of the FW recirculation valves to either the FW pump control switch (if in the RECIRC position) or to the automatic controller (if in the AUTO RECIRC position). The controller setpoint was also raised to 4500 gpm (the maximum calculated recirculation flowrate) to ensure that the recirculation valves would remain open (regardless of the position of the FW pump control switch) after the turbine trip reset pushbutton was depressed. Procedurally, the operators are required to place the FW pump control switch in RECIRC when feedwater flow is less than 10,000 gpm.

During this event the FW pump control switch was in AUTO RECIRC when the operators reset the turbine trip. The actual recirculation flow was approximately 6000 gpm. The controller drove the FW recirculation valve closed and undershot the desired 4500 gpm flowrate and a trip of the main feedwater pumps resulted from low flow conditions. Warning placards were placed near the turbine trip reset pushbuttons to ensure the FW pump control switch is placed in RECIRC prior to resetting a turbine trip.

## 3. AFAS Reset Time

Operations identified that the AFAS Channel C steam generator-1A low level trip signal did not reset in the same time frame as the other AFAS level channels. Based upon this problem definition, I&C maintenance checked that the AFAS level reset was properly calibrated for AFAS steam generator-1A channel MC (Work Order 99019908).

Further investigation revealed that the reactor protection system (RPS) steam generator low level trip signal for channel MC also did not reset until the same delayed time frame as AFAS steam generator 1A channel MC. ERDADS post-trip data was retrieved for the steam generator narrow range level channels. A review of this data indicated that the L-9013C loop was reading lower than the other narrow range level channels by approximately one percent of span during the post-trip recovery of steam generator level. When the auxiliary feedwater system had returned steam generator 1A level to above the AFAS reset point all of level channels reset except Channel C. The reset of the three of the four steam generator 1A level signals resulted in the reset of the AFAS-1 signal terminating AFW flow to steam generator 1A. Due to the termination of AFW flow, steam generator 1A level did not get high enough to reset AFAS steam generator 1A channel MC until later when operators manually increased the steam generator 1A level.

The AFAS and RPS functioned properly in response to the decrease in steam generator level. The steam generator 1A channel C level trip signals actuated at

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## Cause of the Event (cont'd)

the correct setpoints. The time delay in resetting the steam generator 1A Channel C level trip signals was due to a minor difference in the measured level.

## 4. Turbine Control Oil Leaks

A DEH leak was identified and at the 'B' intercept valve and a turbine auto stop oil leak was found at PS-22-117, the emergency trip auto stop oil pressure switch. The 'B' PCV-10-039 pipe plug was tightened. The leak at PS-22-117 was repaired via Work Order 99019379.

## Analysis of the Event

This event is reportable under 10 CFR 50.72(a)(2)(iv) as "... any event or condition that resulted in a manual or automatic actuation of any Engineered Safety Feature (ESF) including the Reactor Protection System (RPS)..."

## Analysis of Safety Significance

All safety systems responded to the turbine/generator trip as designed. Therefore, this event had no impact to the health and safety of the public.

## Corrective Actions

1. The three potentially defective diaphragms were replaced under Work Order 99019906.
2. Warning placards were placed near the turbine trip reset pushbuttons to ensure the FW pump control switch is placed in RECIRC prior to resetting a turbine trip.
3. The turbine control oil leaks were repaired (the leaking DEH pipe plug on the 'B' intercept valve was tightened under Work Order 99019738 and the turbine control auto stop oil leak at PS-22-117 was repaired under Work Order 99019379).

## Additional Information

Failed Components Identified

Component: Low Bearing Oil Trip Protective Device Diaphragm  
Manufacturer: Westinghouse  
Part No. 268A111001

Similar Events

None